

TENTH

ANNUAL ANNOUNCEMENT

OF THE

POLYTECHNIC COLLEGE,

OF THE

STATE OF PENNSYLVANIA.

SESSION 1862-3,

AND

CATALOGUE OF THE OFFICERS AND STUDENTS.



PHILADELPHIA:

M-FARLAND & THOMSON, PRINTERS, 311 WALNUT ST.

1862.





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THE POLYTECHNIC COLLEGE OF THE STATE OF PENNSYLVANIA

W. Steel Engraver

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The Scientific School.

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The School of Civil Engineering.

The School of Mines.

The School of Practical Chemistry.

The School of Mechanical Engineering.

The Architectural School.

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# Announcement.

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The Faculty of the POLYTECHNIC COLLEGE of the State of Pennsylvania respectfully announce that during the summer vacation, their President will visit all of the principal Polytechnic Schools of Europe, study the most approved methods, and purchase means of instruction similar to the best employed in those Institutions. Upon his return at the opening of the session, the Faculty will hasten to introduce the valuable improvements which the large experience of the Old World has recently made in the Polytechnic System of Education. In thus redeeming their pledge to the American student of Civil, Mining, and Mechanical Engineering, Chemistry, Architecture, Metallurgy and Applied Science, that the facilities afforded here shall be fully equal to those found abroad, the Faculty would seek to manifest not only how fully they appreciate the annually increasing patronage hitherto received, but also their determination to render the Institution more worthy of the flattering confidence of distinguished scientific and practical men, which it at present so liberally enjoys.

The Polytechnic College, as its name indicates, is a collection of Technical Schools, or schools of instruction in the several departments of learned industry. It comprises the School of MINES for professional training in Mine Engineering in the best methods of determining the value of Mineral Lands, and of analyzing and manufacturing Mine Products. The School of CIVIL ENGINEERING, in which are taught the most approved principles and methods involved in the construction of Roads, Railroads, Bridges, and other Public Works. The School of PRACTICAL CHEMISTRY, with its well appointed laboratory, affording facilities for acquiring a knowledge of the science as well as of its applications to important Manufactures, to Analysis, Agriculture, and the Arts. The School of MECHANICAL ENGINEERING, in which a full course is given on Mechanical Philosophy and the Principles of Machines, on the Location and Construction of Engines, Furnaces, Foundries, &c. The School of ARCHITECTURE designed by means of Lectures on the History and Principles of Construction, of studies of the Orders and Styles, and of practical lessons in Modelling in Clay and Plaster, to qualify the student for his profession. In addition thereto the SCIENTIFIC School for students of general science has been established, and the six schools are in full and successful operation. It is hoped that the liberal and earnest co-operation of the friends of Agriculture will enable the Trustees to complete the organization of the School of AGRICULTURE by providing a Model Farm.

By training our youth in one or more of these schools, and thus enabling companies engaged in works of improvement to obtain Technicians of American education, competent for all the lucrative and honorable trusts which the indus-

trial enterprises of the country devolve upon our citizens, the College has become an important agent in the skillful and economical development of the vast material resources of the continent, and in the elevation of the industrial professions to their true rank in the scale of human employments.

While supplying an education solid, elevated and usefully applicable in all the higher departments of construction and production—one which prepares for wider fields of honorable employment in *civil* life than any which has hitherto been afforded in America—the Faculty gladly respond to public expectation, and adapt the resources of the Polytechnic College to the present *military* necessities of our country.

The experience of the War has especially shown the want of intelligent professionally-educated officers, possessing the requisite knowledge of Military Engineering and of Tactics. The Military Department of the College has, therefore, been placed under the superintendence of an experienced Graduate and former Instructor in West Point, the use of the spacious State Armory, convenient to the College, granted for infantry drill and sword exercise, a supply of arms received from the Adjutant-General of the Commonwealth, two light field-pieces obtained for artillery drill on grounds in the environs, the use of cleared land for practice in laying out and constructing Field Fortifications, and of a contiguous forest for the supply of materials for Gabions, &c., has also been secured, and the most approved Text-Books have been selected.

The Course will include the scientific portion of the curriculum of the School of Civil Engineering, page 11, as well as the subjects specified under the head of Military Engineering and Tactics in the Summary of the Studies, page 18.

The thanks of the Faculty are due to Daniel M. Keim, Esq., for his recent donation of a valuable Reflecting Goniometer, and to Jno. Warner, Civ. Eng. for a set of Models, illustrating Railroad cutting and embankment.

The system of instruction of the Polytechnic College, which has been found admirably adapted to supply all the requirements of the American student, is faithfully carried out by daily instruction and illustration, followed by examinations in all the Departments; and the Professors will call to their aid a well furnished Analytical Laboratory, extensive Apparatus, Models of Mines, Buildings, Bridges, Engines, and Furnaces, Cabinets of Art and of Minerals, Diagrams, and other means of illustration,

The Faculty, fully alive to the responsibilities of their position, will also seek to employ, in the instruction of their classes, all the resources which the City affords. Philadelphia, by her superior foundries, workshops and factories, furnishes all needed opportunity for the inspection of the best applications of machinery, and her extensive public works, her contiguity to mines of Coal, Iron, Zinc, Lead, Copper, and Nickel, and her railroad communication with them, present eligible practical facilities to the student of Mining and of Engineering. All, indeed, concede that this city is the proper seat of the first American Polytechnic College.

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## ACCOMMODATIONS AND ADMISSION.

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### The Building.

The College edifice, corner of Market Street and West Penn Square, is situated in the centre of the city, and opposite Penn Square, a pleasant and healthful place of resort during the greater part of the year.

The building is well adapted to the extensive course of instruction provided for in the liberal plan of education adopted by the Trustees.

The ground floor contains the Analytical Laboratory, arranged on the German plan, and provided with furnaces, apparatus, tests, and re-agents, for the performance of metallurgic processes, of the operations illustrative of the principles of the science, and of the analysis of organic and inorganic compounds.

The Lecture Room, and the Class Rooms of the Professors, are spacious, well ventilated, and comfortably furnished; and a carefully conducted Gymnasium affords safe and healthful exercise during the daily intermissions.

The Drawing Room has the advantage of being lighted from the roof, and affords superior facilities for studying the Art of Design in any of its departments.

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### The Cabinets.

The Cabinets of Physics and of Chemistry comprise a fine collection of specimens, instruments, and apparatus for the illustration of the Lectures on those sciences.

The Geological and Mineralogical Cabinets contain a set of Crystal Models, from Vienna, showing the various forms of crystals which occur in nature and among the products of art; an instructive series of specimens illustrating the characters of ores and minerals used in the arts; and a col-

lection arranged according to Geological position, each formation in which fossils occur being represented by those which are characteristic. Valuable additions to the Cabinets are constantly being made by exchange and purchase. An extensive and well-selected collection, brought together without regard to cost, by a devoted mineralogist, during many years' residence in Europe, has been purchased and placed in the cases. Two excellent suites of specimens, illustrating the Geology and Mineralogy of Berks, Laneaster, and Delaware Counties, Pa., have recently been donated to the College.

The formation of a Cabinet of Models of Mining and other Machinery has been commenced, to which additions will be made as fast as the necessary means are obtained.

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## Admission.

Candidates for admission to any of the Technical Schools at the beginning of the Autumnal Session are examined in the English branches, including the first four books of Geometry (Legendre), and in Algebra to Equations of the second degree.

For admission to Scientific School see following page.

Candidates for advanced standing will be examined on all the studies previously pursued by the members of the class to which they aspire.

Bachelors of Arts, graduates of respectable colleges, may enter the second-year course in any of the Technical Schools, and become candidates for the degree of that school at the expiration of one year.

Students who wish to attend *partial courses* are admitted without previous examination. Portions of the instruction in any department may be pursued for one or more sessions. Gentlemen may therefore be prepared fully or partially for any of the Industrial Professions; and *Assistant Engineers*, when off duty during the winter session of the College, may perfect themselves in those branches of their profession in which they are deficient. Certificates of attendance and proficiency may be granted to partial course students after examination.

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## DEPARTMENTS AND DEGREES.

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### The Scientific School.

The SCIENTIFIC SCHOOL is designed for students who may not be fully prepared to enter any of the Technical Schools, or who may not prefer a professional Course in one of the industrial arts, and who yet wish to avail themselves of the privileges of the College instruction and discipline.

ADMISSION.—To realize all the advantages of the course, students should be able to prosecute vigorously the study of Geometry and Algebra. The mean age of the class of last term was seventeen years; but youths of sixteen may be admitted.

STUDIES.—Those branches of knowledge which are alike indispensable to every young man about to study a profession and to every one who pretends to be educated, are here united in a COURSE OF ONE YEAR.

The Course includes Elementary Mathematics (Geometry, Algebra, etc., invaluable as the basis of reasoning); the Analysis and Criticism of the English Language, and their application in Original Compositions; Drawing from copies and from objects; the principles and practice of Book Keeping, and Mechanical Philosophy, Chemistry, and the systems of classification of the principal departments of Natural History. The natural and experimental sciences are taught by recitation, lecture, examination, and practical illustration. Every student is expected, after reasonable probation, to take notes of the lectures, and to prepare fairly-written reports of them. These reports are subsequently presented, criticised, and corrected before the class.

HOURS from 9 A.M. to 2 P.M.

When the time of students of the Scientific School will permit, a short, afternoon exercise in the French, Spanish, or German Language, twice or thrice a week, is recommended.



## Professional Schools.

In the Technical Schools of the Polytechnic College, theory and practice are so combined as to insure to those who enjoy the honors of our Diploma, the entire confidence of employing parties, and of companies engaged in works of improvement. Our graduates are successfully practising their professions in various portions of the United States and Spanish America.

To entitle a student to the degree of Bachelor in any of the Professional Schools, he must have complied with the following conditions, to wit: He must have paid all his College fees, including the graduation fee; he must have pursued the prescribed course of study; he must have composed and delivered to the President of the Faculty, at least one month before Commencement, a Thesis on a subject appertaining to the Technical course which he is pursuing; he must accompany his thesis with plans and elevations, when necessary for the elucidation of the same; and he must have passed a satisfactory examination, both oral and written. In particular cases, and with the consent of the Faculty, certain studies may be substituted for others. Due credit will always be given for studies prosecuted in advance of position.

In case of the failure of a candidate, his graduation fee will be returned to him, but his essay will be retained by the Faculty.

The Master's degree will be conferred, in course, on Bachelors of three years' standing, who have sustained a good moral character, and have devoted themselves to the practice of one of the Technical professions.

## The School of Civil Engineering.

ORGANIZED 1853.

Upon the Civil Engineer depends the location, construction, and perfection of those great avenues of intercommunication by which the products of industry are transported, the transmission of intelligence and the healthy circulation of society secured, customs and courtesies interchanged, and civilization and national prosperity advanced. The business of the Engineer has thus assumed a public—a national importance. It demands not only a thorough knowledge of Mathematics, and of the use of instruments in field operations, but of the means of judging of the Geological structure and Mineralogical resources of the country through which he is projecting his lines of improvement; of the composition and strength of materials employed for embankments, culverts, and bridges; of the Chemical and Mechanical causes which destroy substances used in construction, as well as the strain to which weights at rest, moving at slow rates and at high velocities subject his works.

On him frequently devolves the selection of the most available propelling power, whether air, water, animals, or steam; and its application agreeably to the best methods. The study of these forces, therefore, must constitute a portion of his instruction. Important, also, is a cultivated taste in Architecture, and a knowledge of the principles of that beautiful and interesting branch of art. In order, easily and tastefully to map out his survey, as well as to express his conceptions of Architectural beauty, the art of Design must be studied and its principles applied. Way-stations and depots, bridges, and public works, are now required to be not only conveniently situated and arranged, and securely constructed, but their exterior must be symmetrical and in most cases chastely and consistently ornamented.

The prescribed course of CIVIL ENGINEERING, while it compels the acquisition of no extraneous knowledge, renders all those studies obligatory which are necessary to the education of the thorough-bred Engineer.

### FOR THE DEGREE OF BACHELOR OF CIVIL ENGINEERING.

#### First Year Course.

MATHEMATICS.\*  
GENERAL CHEMISTRY.  
GENERAL PHYSICS.  
GENERAL MECHANICS.  
FIELD PRACTICE (Commenced).  
DRAWING (Topographical).  
MINERALOGY.

#### Second Year Course.

MATHEMATICS, CIVIL ENGINEERING,  
and PRACTICE.  
GEOLOGY.  
APPLIED MECHANICS.  
ARCHITECTURE.  
INDUSTRIAL PHYSICS.  
DRAWING and MODELLING.

\* For further details, see "Summary of the Studies," page 17.



## The School of Mechanical Engineering.

ORGANIZED 1854.

To the Mechanical Engineer is confided the important duty of multiplying the effective industry of the nation, and by the perfection and concentration of labor-saving machinery, of enabling us in manufactures to compete successfully with foreign countries where labor is cheaper. But the knowledge he requires in order to direct the fabrication of machinery, is not only that of the vice-bench and the turning-lathe. He must be familiar with the Science of Mechanics in its fullest extent, and with the principles of Physics; with the tenacity and durability of materials, the expansive power of vapor and of air; the force of currents, and of falls of water; of wind, and the nature and extent of electrical and magnetic influences. Organic Chemistry reveals to him the properties of the substances used for textile fabrics, Mineralogy, the sources of the metallic and earthy bodies which he employs, and Industrial Chemistry and Metallurgy teach him the economical methods of moulding these materials into an infinity of required shapes, and of making them subservient to the uses of man. The Art of Design is as indispensable to the Mechanical as to the Civil Engineer, and the locating and arranging of workshops and factories involves some knowledge of the builder's art.

In this Department the class are conducted through a full course on Mechanical Philosophy, and the Principles of Machinery; on the sources of Mechanical Power—Air, Water, Steam, Electro-Magnetism, etc.; on the Telegraph; on the location and construction of Engines, Furnaces, Foundries, etc. The course is elucidated by Models, Machinery, Diagrams, and Experimental Apparatus.

### FOR THE DEGREE OF BACHELOR OF MECHANICAL ENGINEERING.

#### First Year Course.

MATHEMATICS.  
GENERAL CHEMISTRY.  
GENERAL PHYSICS.  
GENERAL MECHANICS.  
DRAWING (Mechanical).  
MINERALOGY.

#### Second Year Course.

MATHEMATICS.  
GEOLOGY.  
CONSTRUCTION OF MACHINES.  
METALLURGY.  
APPLIED MECHANICS.  
INDUSTRIAL PHYSICS.  
DRAWING AND ARCHITECTURE.

## The School of Chemistry,

ESTABLISHED 1849; ORGANIZED UNDER COLLEGE CHARTER 1853:

Is designed to afford facilities for acquiring a thorough knowledge of the Science, which shall equal in appointments, cheapness, and thoroughness of Instruction, those of the European Laboratories.

The time has gone by when Chemistry, the most rapidly advancing science of the day, and that which, probably more than any other, is contributing to human comfort and human progress, can be learned from dictation. The test-glass must be in the hands of the Student, and those reactions and processes which he would understand, he must repeat for himself.

The course comprehends the Principles of the science, and their application to Agriculture, to the Arts, and to Analysis; to the examination and smelting of Ores; to the alloying, refining, and working of Metals; to the arts of Dyeing and Pottery; to the Starch, Sugar, Lime, and Glass manufacture; to the preparation and durability of Mortars and Cements; to means of disinfecting, ventilating, heating, and lighting. Students are practised in Manipulations, Testing in the Arts, Qualitative and Quantitative Analysis of Minerals, Soils, etc.

### FOR THE DEGREE OF BACHELOR OF CHEMISTRY.

#### First Year Course.

GENERAL CHEMISTRY.  
GENERAL PHYSICS.  
MINERALOGY.  
GEOLOGY.  
LABORATORY PRACTICE.

#### Second Year Course.

INDUSTRIAL CHEMISTRY.  
ANALYTIC CHEMISTRY (Practice).  
AGRICULTURAL CHEMISTRY  
INDUSTRIAL PHYSICS.  
METALLURGY.  
NATURAL HISTORY (Plants).  
DRAWING, OR A MODERN LANGUAGE.

### PRACTICAL CHEMISTRY.

Students who enter for Special Laboratory Instruction and Practice will receive individual attention, and enjoy all the privileges of the department, during the entire daily session. As each works independently of his fellow-student, he is at perfect liberty to pursue that course of experimental research which may be demanded by his taste or his future pursuits, be it the examination of Manufactured Products, the Analysis of Earths, of Metallic Ores and Poisons, of Soils, of Seeds and other Vegetable Substances, of Healthy and Morbid Animal Fluids, etc.

	<i>Per Month.</i>	<i>Per Qr. of 3 Months.</i>
Students working every day in the week.....	\$20 00	\$50 00
“ “ every other day in the week.....	15 00	37 50

All fees payable in advance. Students may enter whenever there is a vacancy. Each will be expected to provide himself with a mouth Blow-Pipe, and Platinum Wire, Foil, and Crucible. Gas, Fuel, Alcohol, Reagents, and Apparatus will be supplied without extra charge, save for the breaking of glass-ware.

## The School of Mines.

ORGANIZED 1857.

The object of the School of Mines is the skillful and economical development of the mineral wealth of the United States: 1. By imparting a thoroughly scientific and practical education in Mine Engineering, and in the best methods of determining the value of mineral lands, and of analyzing and manufacturing mine products; 2. By the formation of a Mining Museum—comprising Cabinets of Mineralogy, Geology, and Metallurgy, of models, plans, and sections of Mines and Furnaces, and of the Tools and Implements used in Mining and Smelting; 3. By the collection of Works of reference, of drawings and descriptions of deposits and basins, and of Reports of Mining Companies, etc.

The Engineer of Mines must bring to his preliminary exploration of a mineral region, an intimate acquaintance with Mineralogical and Palæontological characters, as well as with the laws of Geological formation and displacement. His subsequent workings—opening shafts, drift, and drains, shoring his excavations, following the dip and direction of strata, or descending perpendicularly—demand quite as high a degree of Mathematical skill as do the surface operations of the Civil Engineer. His instruments are frequently those of Physics and of Chemistry, and can be successfully employed only when he is acquainted with those sciences. A knowledge of the principles of machinery alone can guide him in the selection and employment of power, for the purposes of elevating, screening, draining, and ventilating.

Full courses of instruction are given on the form, structure, constitution, and classification of Minerals; on Geological Exploration, on the Carboniferous, Metalliferous, Saliferous, and other Rocks; on Economic and Agricultural Geology, Springs, and Artesian Wells; on Drifting, Draining, Ventilating, and Working Mines, etc.

### FOR THE DEGREE OF BACHELOR OF MINE ENGINEERING.

#### First Year Course.

MATHEMATICS.  
GENERAL CHEMISTRY.  
GENERAL PHYSICS.  
GENERAL MECHANICS.  
MINERALOGY.  
DRAWING.

#### Second Year Course.

MATHEMATICS.  
GEOLOGY and MINERAL ANALYSIS.  
MINE ENGINEERING.  
APPLIED MECHANICS.  
METALLURGY.  
INDUSTRIAL PHYSICS.  
DRAWING.

# The Architectural School.

ORGANIZED 1860.

## ADVISORY COUNCIL ON THE ARCHITECTURAL SCHOOL.

JNO. NOTMAN,

GUSTAVUS RUNGE,

JNO. McARTHUR, Jr.,

EDWARD COLLINS,

SAMUEL SLOAN.

The Architectural School has been organized agreeably to the desire of the profession in Philadelphia, as expressed in the following Resolution, unanimously adopted at a meeting held in 1860.

*“Resolved, That we recognize the determination of the Polytechnic College of Pennsylvania to institute a class for the study of Architecture, as a most important step in the advancement of this useful and ornamental art, and one which we most cordially approve, and will use our best efforts to foster and assist.”*

A collection of upwards of 250 dressed specimens of building and ornamental stones, a suite of Plaster Casts, engraved Studies of the Orders and Styles, and models of Arches, Roof Constructions and of all the joints used in Carpentry, have been procured, and the Courses of Lectures and Practical Lessons begun. The Lectures treat of the History of the Art, of the Principles and Methods of constructing Frames, Beams, Roofs and Arches, of the structure of Foundations and retaining Walls, and of the principal Orders and Styles.

The Practical Lessons include Modelling in clay and plaster of stone Arches, Stairways, &c.; Drawing, shading, and coloring; Designs for private and public edifices, &c.

## FOR THE DEGREE OF BACHELOR OF ARCHITECTURE.

### First Year Course.

MATHEMATICS.  
GENERAL CHEMISTRY.  
GENERAL PHYSICS.  
GENERAL MECHANICS.  
MINERALOGY.  
DRAWING AND COLORING.

### Second Year Course.

MATHEMATICS.  
GEOLOGY.  
INDUSTRIAL PHYSICS AND CHEMISTRY.  
APPLIED MECHANICS.  
PRINCIPLES OF ARCHITECTURE.  
MODELLING IN CLAY AND PLASTER.  
DRAWING, COLORING, AND DESIGNING.

## EVENING DRAWING CLASS.

In addition to the instruction and practice in Architectural, Topographical, and Mechanical Drawing, which forms part of the regular College course, a class in Drawing and Architecture, under the direction of the Professor of Engineering, Mechanics, and Drawing, will be formed in the Evening during the Winter, and be open to all, whether matriculants of the College or not, attendance of course being optional. Fee \$5 for 12 weeks.

In order to encourage proficiency in this branch, full course second-year students will be furnished with the Evening Drawing ticket free of charge.



## The Agricultural School.

PARTIALLY ORGANIZED.

Agriculture draws from Chemistry an exact knowledge of the constituents of the soil and the crop, and thus obtains rules for the amelioration of the former and the profitable cultivation of the latter. Farm Machinery, to be effective, must be constructed in accordance with the principles of Mechanics. The Geological and Mineralogical character of the soil, sub-soil, and the more deeply-laid strata, control all the farmer's schemes of improvement. An acquaintance with Vegetable structure lends a new intellectual charm to his manual pursuits. Zoology is the best introduction to a knowledge of breeds, and the scientific improvement of stock; and cultivated habits of observation give him an exact appreciation of the practical value of meteorological facts and phenomena.

The instruction in this school is designed to run parallel with practice in farming operations. The means of reaching and leaving the city are so multiplied and rapid, that, until a Model Farm is provided for the purpose, students reside with intelligent agricultural instructors in the neighborhood of Philadelphia, attend college daily, and return in season to inspect and participate in the duties of the farm; or, if preferred, five or six months may be spent in the city in attendance on Lectures, and in the Laboratory, and the remainder of the year, including all the growing season, be devoted to farm practice. This last arrangement has been found not only pleasing to the student, but conducive to his rapid and thorough progress in both the theory and practice of Agriculture.

### FOR THE DEGREE OF BACHELOR OF AGRICULTURE.

#### First Year Course.

MATHEMATICS.  
GENERAL CHEMISTRY.  
GENERAL PHYSICS.  
GENERAL MECHANICS.  
LAND SURVEYING.  
DRAWING.

#### Second Year Course.

MINERALOGY.  
GEOLOGY.  
AGRICULTURAL CHEMISTRY.  
ANALYTIC CHEMISTRY.  
NATURAL HISTORY (ZOOLOGY and BOTANY.)

## SUMMARY OF THE STUDIES

OF THE

## Professional Schools.

**MATHEMATICS.**—*First Year.* Algebra completed; Geometry completed; Mensuration; Plane and Spherical Trigonometry; Nautical Astronomy; Surveying. *Second Year.* Descriptive Geometry—its theory and applications; Analytical Geometry; Shadow and Perspective; Differential and Integral Calculus.

**GENERAL PHYSICS.**—Properties of Matter; Form; Molecular Action; Heat; Steam; Magnetism; Static and Dynamic Electricity; Electro-Magnetism; Acoustics; Light; Photometry.

Students are exercised during the course in determining the specific gravities of solids, liquids, vapors, and gases; in the employment of the Barometer; the construction and use of Thermometers; in the use of the Hygrometer and Photometer.

**GENERAL MECHANICS.**—Laws of Motion and of Equilibrium; Statics of Solids; Hydrostatics; Hydrodynamics.

**GENERAL CHEMISTRY.**—Nomenclature; Laws of Combination; Non-Metallic Elements; Metals; Acids; Bases; Salts; Organic Acid, Alkaloid, and Neutral Bodies; Reagents; Testing in the Arts.

There is a weekly exercise in manipulations, during which the students repeat, in the Laboratory, all the important experiments executed by the Professor in the Lecture Room.

**MINERALOGY.**—Crystallography; Form, Structure, Optical Properties, Chemical Characters, and Classification of Minerals.

**GEOLOGY.**—Physical Geography; Study of the Earth's Surface; Influence of the Atmosphere, of Water, of Ice, of Volcanic Action, and of Coral Growth; Geological Periods; American Classifications and Systems of Rocks; Lithological and Palæontological Characters of each Formation; Comparison of it with its English, German, and French Equivalents; Economic Geology; Artesian Wells.

Students will make excursions with the Professor, into the interesting neighboring localities of Pennsylvania and New Jersey.

**NATURAL HISTORY.**—Organization, Functions, and Classification of Animals; Animal Force, Traction, etc.; Preservation of Meat; Animal Products—Milk, Butter, Cheese, Tallow; Animal Fibre; Bone; Artificial Incubation; Useful Insects and their Products; Insects injurious to Vegetation.

Structural Botany; Relation of Plants to the Soil and the Atmosphere; Classification of Plants; Wood, Fibre, Starch, Sugar, Tannin, Oil, Color-producing Plants; History of Vegetable Substances used in the Arts.

Botanical excursions into the environs will be made during the floral season.

**DRAWING.**—Linear; by the Scale; Shading; Elevations and Plans of Dwellings, Stores, Bridges, Factories, Implements, Apparatus, Machinery, and Public Edifices; Mapping and Plotting; Drawing from the Round; Geological Sections; Plans and Sections of Mines, etc.

**INDUSTRIAL PHYSICS.**—Kinds and uses of Fuel; their Comparative Value; Structure of Furnaces and Boilers; Transmission of Heat; Refrigeration, Vaporization, Distillation, Evaporation; Heating of Liquids; Warming and Ventilating Houses and Public Buildings.

**APPLIED MECHANICS.**—Statics of Articulated Systems; Rigidity of Chains and Cordage; Effects of Friction and Shock; Dynamometers; Pressure of Water; Ajutages; Theory of Water Wheels; Machines to raise Water; Blowing Machines; Marine Engines.

**CONSTRUCTION OF MACHINES.**—Means used to Impart, Transmit, Modify, and Regulate the Motion of Machines; Properties of materials used in the Construction of Machines; Flexible, and inflexible Joints; Employment of Formulæ.

Students will visit the large machine-shops with which Philadelphia abounds, and familiarize themselves with the machinery used in the working of metals, etc.

**ANALYTIC CHEMISTRY.**—Ends, Means, and Methods of Analysis; Recognition and Dosing of Non-Metallic and Metallic Bodies, Acids, and Bases; Qualitative and Quantitative Analysis of Ores, Limestones, Coals, Mineral Waters, Soils, Manures, and Products of Art; Detection of Poisons; Assaying; Organic Analysis; Soaps; Alcoholic Liquids.

**INDUSTRIAL CHEMISTRY.**—Filtration and Purification of Water; Extraction of Sulphur, Iodine, Starch, Sugar, Salt, Oils, Fats, and Resins; Manufacture of the Mineral Acids, of Soda and Potash, and their Salts; of Alum, White Lead, Illuminating Gas, Alcohol, Vinegar, Animal Black, Paper, Soaps, Glass, and Pottery; Tanning, Dyeing, Bleaching, etc.

**AGRICULTURAL CHEMISTRY.**—Vegetable Nutrition; the Constituent Elements of Plants; Source and Assimilation of Oxygen, Hydrogen, Nitrogen, Carbon, and the Inorganic Elements; Rotation of Crops; Marl, Lime, Plaster, Shells, Bone-dust, Guano, Barnyard and Street Manures; Green Soiling; Fermentation; Vegetable Mould; Classification of Soils; Residue of Crops; Meteorological Considerations; Draining; Subsoiling; Springs; Irrigation.

**CIVIL ENGINEERING.**—Use of Instruments, Compass, Level, Transit, Theodolite, and the Common, Aneroid, and Thermometric Barometers; Equilibrations of Arches; Stability of Foundations on Land and under Water; Principles of Framing, Stonecutting, Masonry, and Carpentry; Bridging; Dimensions and Strength of Walls, Arches, Pillars, Frames, Trusses, Abutments, and Piers; Locating, Staking Out, Constructing, and Estimating Roads, Railroads, and Canals; Laying out Curves; Stationary Engines, and Locomotives; Culverts, Drains, and Water-Works.

Tuesday is field day, when the students are exercised with the Instruments.

**ARCHITECTURE.**—Frames for Cross-strain; Solid-built and Open-built Beams; Framing of intermediate Supports; Wooden and Iron Arches; Wooden and Iron Roof Construction, &c.; Structure of Foundations; Stone, Brick, and Rubble-work; Retaining Walls, relieving Arches, &c.; Parallel of the Orders; Ancient and Modern Styles; Principles of Design.

**MODELLING** to scale, of Stone Arches, Staircases, etc., in both Clay and Plaster.

**METALLURGY.**—Smelting of Iron; Ore, Fuel, Flux; Qualities of Pig Iron; Puddling, Refining, Forging, Rolling; Employment of Waste Gases and Heat; Blowers; Patterns, Moulding, Casting; Nature and Manufacture of Steel; Metallurgy of Zinc, Lead, Tin, Copper, Silver, etc.

Visits to smelting and other furnaces, in and near the city, will be made from time to time.

**MINE ENGINEERING.**—Geographical Distribution of Mines; Reconnoissance; Order of Exploration; Use of Instruments; Location of Mines; Mode of Determining the best Position for Openings; Processes of Excavation; Employment of Tools and Powder; Boring; Quarrying; Drifts, Slopes, Shafts, Gangways, Chambers, Galleries, Branches, Workings, Timbering, Shoring; Principles of Framing; Draining, Ventilation; Davy's Lamp; Faults, Squeezes; Modes of Measuring Mines, inside, outside; Computation of Quantity; Removal of Pillars; Elevating, Crushing, Screening, and Transportation.

Opportunities will be afforded to visit the coal, iron, and other mines in Eastern Pennsylvania.

**MODERN LANGUAGES.**—French and Spanish Languages and Literature; German Language and Literature.

**INDUSTRIAL JURISPRUDENCE**, including the Laws of the United States and of Foreign Countries, relating to Patents for Inventions and Discoveries, and to Copyright of Designs.

**MILITARY ENGINEERING AND TACTICS.**—Siege Operations; Preparing Timber and Brush; Tracing, Commencing, and Executing the First and Second Parallels and their Approaches; Arrangement and Regulation of Working Parties; Special Duties of Sappers and Miners; Construction of Military Bridges. Strategy: Its Principles Explained and Applied to the Management of Armies during a Campaign and on the Field of Battle; Its History; Examination of Instances Illustrating the Causes of Victory or Defeat. Plan, Profile, Internal and External Arrangements of Field Fortifications, Entrenched Camps, Stockades, Redoubts, Batteries, etc.; Effects of Musketry and Artillery, Practice of Gunnery, Tactics of Artillery and Infantry, Sword and Bayonet Practice, Squad and Company Drill, etc.



## ATTENDANCE AND EXPENSES.

### Sessions.

The College year is divided into three sessions. The first or Autumnal Session of the year 1862-63, begins on Tuesday, September 16th, and ends on Friday, October 31st. The second or Winter Session begins on Monday, November 3d, and ends on Friday, February 27th. The third or Spring Session begins on Monday, March 2d, and ends on Thursday, June 25th.

### Terms.

#### PAYABLE AT THE COMMENCEMENT OF THE SESSIONS.

	SCIENTIFIC SCHOOL.	TECHNICAL SCHOOLS.	
		<i>First Year Course.</i>	<i>Second Year Course.</i>
Matriculation Fee, paid once only	. . . . .	\$5	
Autumnal Session, full course	. . \$15	15	\$20
Winter     "     "	. . . 30	40	50
Spring       "     "	. . . 30	40	50
	<u>          </u>	<u>          </u>	<u>          </u>
	\$75	\$100	\$120

Graduation fee, \$10. Modern Languages (optional), \$10.

For partial courses, the fees vary from \$10 to \$50 per session, according to the studies embraced.

Before a student can receive a ticket of admission to any of the Technical Schools, it is necessary that he enter his name and post-office address in the College Register, and purchase his matriculation ticket. It is desirable that students matriculate and obtain their tickets with as little delay as possible after their arrival in the city.

## Examinations and Recapitulatory Lectures.

The aim of each Professor is to render the instruction in his department as thorough as possible. Oral examinations and reviews are held weekly, and oral and written examinations on all the studies at the end of each session.

Members of classes in attendance on lectures, appoint weekly one from their own body to recapitulate the experimental lectures which one of the Professors will give during the ensuing week. These recapitulatory lectures are delivered in the presence of the Professor and the class. The student is allowed the use of apparatus, and thus is exercised in public speaking, in experimenting, and in imparting the knowledge he has acquired. To all, and especially to those who are preparing to become teachers, lecturers, or professors of experimental science, this exercise is of great advantage.

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## Society.

The Philotechnic Society, composed of students of the College, holds meetings in the College Building, under the sanction of the Faculty, for the purpose of discussing scientific questions, reading essays, etc.

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## Commencement.

The public Commencement for conferring Degrees will be held on the last Thursday in June. The week preceeding will be devoted to the annual examination.

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## Boarding.

Boarding may be obtained as cheaply in Philadelphia as in any other large city in the Union, and to the scientific student the collateral advantages of a residence here are not equalled elsewhere in America.

Additional information as to terms, courses of study, boarding, etc., may be obtained by addressing

ALFRED L. KENNEDY, M.D.,  
*President of the Faculty.*

# Catalogue.

At the Annual Commencement of the Polytechnic College of the State of Pennsylvania held in Concert Hall, Philadelphia, on Thursday evening, June 26th, 1862, the Introductory Address was delivered by Hon. THOMAS H. BURROWS LL. D., Superintendent of the Common Schools of Pennsylvania.

LEWIS R. FRANCINE, an Alumnus of the College, and Capt. Co. A. 7th N. J. V. made a brief statement of the operations of the Army in Virginia.

The Degrees of the College (owing to the illness of Gov. CURTIN,) were conferred upon the following gentlemen by MATTHEW NEWKIRK Esq., President by election of the Board of Trustees, and the Charge to the Graduates was pronounced by Hon. Ex-Governor POLLOCK, Director United States Mint.

## BACHELOR'S DEGREES.

### DEGREE OF BACHELOR OF MINE ENGINEERING.

HENRY R. CLARK, Trenton, N. J.

*Subject of Thesis.*—Zinc and its Metallurgy.

JOHN IUNGERICH, Darby, Pa.

*Subject of Thesis.*—Copper and Copper Smelting.

### DEGREE OF BACHELOR OF CHEMISTRY.

CAMPBELL TUCKER, Philadelphia.

*Subject of Thesis.*—Manufacture, Properties and Uses of Soda, its Chlorides, Sulphate, and Carbonate.

### DEGREE OF BACHELOR OF MECHANICAL ENGINEERING.

WILLIAM C. GATZMER, Tacony, Pa.

*Subject of Thesis.*—Motion of Steam.

EDWARD I. H. HOWELL, Germantown, Pa.

*Subject of Thesis.*—The Sewing Machine, past, present, and future.

JEROME KEELEY, Phoenixville, Pa.

*Subject of Thesis.*—Steam Boilers.

### DEGREE OF BACHELOR OF CIVIL ENGINEERING.

JAMES A. BARTON, Trenton, N. J.

*Subject of Thesis.*—The Theory and Principles of Construction of the most economical Wooden Bridges.

CHARLES H. BLACKWELL, Hopewell, N. J.

*Subject of Thesis.*—Manufacture of Illuminating Gas.

JOHN AP J. CHILDS, Philadelphia.

*Subject of Thesis.*—The Common Roads.

HENRY N. HARRISON, Andalusia, Pa.

*Subject of Thesis.*—Irrigation.

JAMES R. MAXWELL, Newark, Delaware.

*Subject of Thesis.*—Water Works and their Construction.

WILLIAM G. NEILSON, Philadelphia.

*Subject of Thesis.*—Tunnelling.

ABNER C. THOMAS, Philadelphia.

*Subject of Thesis.*—Lime, Mortar, and Calcareous Cements.

GEORGE A. VAILLANT, Philadelphia.

*Subject of Thesis.*—Stone Bridges.

### MASTER'S DEGREES.

ON BACHELORS OF THREE YEARS' STANDING.

#### DEGREE OF MASTER OF CIVIL ENGINEERING.

GEORGE E. FORD, Lieutenant 4th Reg. Iowa Volunteers.

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### DISTINGUISHED STUDENTS OF SCIENTIFIC SCHOOL.

THOMAS S. BONSALL, West Philadelphia, Pa.

JOSEPH WOOD, Haddonfield, New Jersey.

R. WALLACE STEEL, Philadelphia, Pa.

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 CLASS OF SESSION 1861-62.
 

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## Technical Schools.

### SECOND-YEAR MEN.

Name.	Post-office.	County.	State.
JAMES A. BARTON,	Trenton,	Mercer,	N. J.
CHARLES H. BLACKWELL,	Hopewell,	Mercer,	N. J.
ELIHU CHAUNCEY, <i>p</i> .	Philadelphia,		Pa.
JOHN AP J. CHILDS,	Philadelphia,		Pa.
HENRY R. CLARK,	Trenton,	Mercer,	N. J.
WILLIAM C. GATZMER,	Tacony,	Philadelphia,	Pa.
HENRY N. HARRISON,	Andalusia,	Bucks,	Pa.
EDWARD I. H. HOWELL,	Germantown,	Philadelphia,	Pa.
JOHN LUNGERICH,	Darby,	Delaware,	Pa.
JEROME KEELEY,	Phoenixville,	Chester,	Pa.
JAMES R. MAXWELL,	Newark,	New Castle,	Del.
WILLIAM G. NEILSON,	Philadelphia,		Pa.
ABNER C. THOMAS,	Philadelphia,		Pa.
CAMPBELL TUCKER,	Philadelphia,		Pa.
GEORGE A. VAILLANT,	Philadelphia,		Pa.

*p* Partial course students.

# Technical Schools.

## FIRST-YEAR MEN.

Name.	Post-office.	County.	State.
OTTO ALBRECHT,	Philadelphia,		Pa.
JOHN B. ATKINSON,	Mullica Hill,	Gloucester,	N. J.
B. NORMAN BAILEY,	Philadelphia,		Pa.
JOHN H. BAUMGARDNER,	Lancaster,	Lancaster,	Pa.
JOHN BIRKINBINE,	Philadelphia,		Pa.
HENRY B. BOYD, <i>p.</i>	Philadelphia,		Pa.
BENJAMIN F. BLOOMINGDALE,	Philadelphia,		Pa.
SYLVESTER BURNHAM, <i>p.</i>	Newburyport,	Essex,	Mass.
SAMUEL N. CALDWELL,	Camden,	Camden,	N. J.
WILLIAM CHISHOLM,	Cleveland,	Cuyahoga,	Ohio.
CLEMENT B. FINLEY,	West Philadelphia,	Philadelphia,	Pa.
SPENCER FULLERTON,	Philadelphia,		Pa.
RIDGEWAY GLOVER, <i>p.</i>	Haddonfield,	Camden,	N. J.
POYNTELL JOHNSTON,	Wilmington,	New Castle,	Del.
WILLIAM JOHNSON,	Brandywine Manor,	Chester,	Pa.
JAMES W. KANE,	Wheeling,	Ohio,	Va.
WILLIAM H. KELLEY,	Philadelphia,		Pa.
HOWARD L. KOONS,	Philadelphia,		Pa.
CHARLES D. LAW,	Carlisle,	Cumberland,	Pa.
LOUIS LEASCH,	Philadelphia,		Pa.
EDGAR S. LOUGEE,	Raleigh,	Wake,	N. C.
FRANK LUKENS, *	Conshohocken,	Montgomery,	Pa.
JAMES F. McCABE,	Havre de Grace,	Harford,	Md.
HENRY MCINTYRE, <i>p.</i>	Philadelphia,		Pa.
HENRY MONTGOMERY,	Bristol,	Montgomery,	Pa.
EDWARD H. READ,	Trenton,	Mercer,	N. J.
SAMUEL R. ROBERTS,	Philadelphia,		Pa.
FRANK ROSENGARTEN,	Philadelphia,		Pa.
EDWARD SLOAN,	Philadelphia,		Pa.
ROBERT S. STEDMAN,	Hartford,	Hartford,	Conn.
JESSE W. WALKER,	New Centreville,	Chester,	Pa.
LEWIS R. WALTON,	Penningtonville,	Chester,	Pa.
WILLIAM E. WEBER,	Pottsville,	Schuylkill,	Pa.
HOWARD WHITE,	Johnstown,	Burlington,	N. J.

\* Deceased.



## Scientific School.

Name.	Post-office.	County.	State.
ERWIN AGNEW,	Philadelphia,		Pa.
CHARLES ALLMENDINGER,	Philadelphia,		Pa.
WILLIAM J. ANSPACH,	Philadelphia,		Pa.
HENRY H. ARTHUR,	Philadelphia,		Pa.
G. M. DALLAS BOLTON,	Norristown,	Montgomery,	Pa.
THOMAS S. BONSALE,	West Philadelphia,	Philadelphia,	Pa.
NARCISSE R. DENIS,	Philadelphia,		Pa.
WASHINGTON J. GRIFFITH,	Norristown,	Montgomery,	Pa.
J. MILTON HAGY,	Philadelphia,		Pa.
HENRY F. HEBERTON,	Philadelphia,		Pa.
FRANKLIN M. JONES,	Philadelphia,		Pa.
B. BERNARD KILLIKELLY,	Paradise,	Lancaster,	Pa.
JAMES M. KREAMER,	Phoenixville,	Chester,	Pa.
FRANCIS W. LEAMING,	Philadelphia,		Pa.
GIFFORD MAXWELL,	Philadelphia,		Pa.
JAMES H. MAYLAND,	Philadelphia,		Pa.
WILLIAM W. MONTGOMERY,	Bristol,	Bucks,	Pa.
WILLIAM A. NEWTON,	Wheeling,	Ohio,	Va.
ROBERT O'CONNER,	Bridesburg,	Philadelphia,	Pa.
JOHN L. PEEBLES,	Carlisle,	Cumberland,	Pa.
JOAQUIN QUILLETZ,	Pinar del Rio,		Cuba.
W. PERCIVAL SCHALL,	Norristown,	Montgomery,	Pa.
FREDERICK S. SCHRACK,	Norristown,	Montgomery,	Pa.
J. FRED'K SCOTT,	Philadelphia,		Pa.
SAMUEL J. SLOAN,	Phoenixville,	Chester,	Pa.
HENRY L. STECK,	Philadelphia,		Pa.
R. WALLACE STEEL,	Philadelphia,		Pa.
JOSEPH M. STURGES,	Philadelphia,		Pa.
JAMES TODD,	Philadelphia,		Pa.
HERMANN VETTERLEIN,	Philadelphia,		Pa.
JAMES M. WATSON,	Philadelphia,		Pa.
WILLIAM F. WITTE,	Skippack,	Montgomery,	Pa.
JOSEPH WOOD,	Haddonfield,	Camden,	N. J.
SAMUEL WOOD,	Haddonfield,	Camden,	N. J.



## UNCLASSIFIED.

Name.	Post-Office.	County.	State.
JOHN L. HANNUM,	Philadelphia,		Pa.
JOHN W. HARTMANN,	" "		"
GEORGE V. HENRIE,	" "		"
JOHN Y. PENNOCK,	" "		"
ADAM W. SAMPLE,	" "		"
STEPHEN W. STRAUB,	" "		"
ZIBA D. WALTER,	" "		"
THOMAS S. WALTMAN,	" "		"
WILLIAM D. YOUNG,	" "		"

## SUMMARY.

Of these there were from	
Pennsylvania, Philadelphia . . . . .	46
" out of " . . . . .	26
New Jersey . . . . .	10
Delaware . . . . .	2
Maryland . . . . .	1
Virginia . . . . .	2
North Carolina . . . . .	1
Ohio . . . . .	1
Connecticut . . . . .	1
Massachusetts . . . . .	1
Cuba . . . . .	1
Total, . . . . .	92

## PROFESSIONAL ENGAGEMENTS

OF THE

GRADUATES OF 1861.

ARTHUR M. CAZIMAJOU, B. CIV. ENG.,

*Havana, Cuba.*

THOMAS DE CUBAS, B. CIV. ENG.,

*Assistant Engineer, Ferro Carril del Oeste, Cuba.*

JOHN FORNANCE, B. CIV. ENG.,

*Assistant Engineer, U. S. N.*

EDWARD S. HUTCHINSON, B. CIV. ENG.,

*Newton, Pennsylvania.*

JOSEPH B. HUTCHINSON, B. CIV. ENG.,

*Draughtsman, Delamater Iron Works, New York City.*

JAMES W. HUTCHINSON, B. CIV. ENG.,

*Assistant Engineer, U. S. N.*

WILLIAM F. LAW, B. CIV. ENG.,

*Assistant Engineer, U. S. N.*

FERDINAND W. ROEBLING, B. CHEM.,

*Assistant Engineer, Jno. A. Roebling's Iron Works, Trenton, N. J.*

LEWIS W. ROBINSON, B. CIV. ENG.,

*Assistant Engineer, U. S. N.*

JOSEPH C. ROOP, B. CHEM.,

*Germantown. Pa.*

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## COLLEGE CALENDAR

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### TENTH YEAR.

SCIENTIFIC SCHOOL opens	September 8, 1862.
TECHNICAL SCHOOLS open	" 16, "
AUTUMNAL EXAMINATION begins	October 29, "
AUTUMNAL SESSION ends	" 31, "
WINTER SESSION begins	November 3, "
ANNUAL ADDRESS before Philotechnie Society	" 3, "
CHRISTMAS VACATION begins	December 24, "
CHRISTMAS VACATION ends	January 1, 1863.
WINTER EXAMINATION begins	February 24, "
WINTER SESSION ends	" 27, "
SPRING SESSION begins	March 2, "
EASTER VACATION begins	April 3, "
EASTER VACATION ends	" 6, "
EXAMINATION of Graduating Class begins	June 10, "
ANNUAL EXAMINATION begins	" 18, "
ANNUAL EXAMINATION ends	" 24, "
COMMENCEMENT	" 25, "